

ZOOLOGY.—*Trends and problems in pelecypod classification (the genus and subgenus)*. DAVID NICOL, Southern Illinois University, Carbondale, Ill.

(Received August 26, 1958)

Many of the ideas set forth in this paper are not original, and the application and manipulation of certain data are, at least in part, not new. However, it is certainly true that many of them are little known and have been overlooked by the present generation of taxonomists. The reason for this seems to be that while the thoughts and writings of certain workers are widely read and often accepted without question, others are ignored or forgotten. It behooves us all to examine the data and ideas of some of the less-known or less generally accepted workers in taxonomy and evolution, for even if we do not agree with their conclusions we may gain a new insight into some of our present problems.

CONCEPT AND SCOPE OF THE GENUS AND SUBGENUS

The essence of classification is the grouping of animals on the basis of their relationship to one another, the genus or subgenus being the lowest taxonomic category for the grouping of related species. It is unfortunate that the lack of proper grouping, among other causes, has led to so much splitting of pelecypod genera and subgenera that the genus is no longer a pragmatic category in preliminary identification of specimens; that is to say, pelecypod specimens must first be pigeon-holed as to family because the identification of finely delineated genera is often not possible at first glance.

It is acknowledged, of course, that difficulties of pelecypod classification stem not only from the minute delineation of genera but also from the size of the entire class.

From the standpoint of described living species, the phylum Mollusca is a comparatively large one. I say comparatively large because it is not more than one-tenth the size of the Arthropoda. Malacologists doing taxonomic work estimate that there are nearly 100,000 described living species. About three-fourths of these are gastropods, and most of the remainder (around 20,000)

are pelecypods. The class Pelecypoda is a prominent fossil group throughout all but the early part of its geologic history (Ordovician to Recent). Nearly 8,000 generic and subgeneric names have been proposed in the class during the past two centuries, in striking contrast to Linné's original establishment of a mere 15 genera (including *Teredo*, which Linné did not recognize as a pelecypod). The number is steadily increasing. For instance, a cursory examination of the *Zoological Record* for the five-year period of 1950 through 1954 reveals that the average number of new genera and subgenera proposed annually is 23. (The actual number is probably slightly higher than this for reasons that need no explanation.) The proposals of new genera and subgenera were made by relatively few taxonomists during this 5-year period.

There have been a few complaints in recent years concerning the number of new genera and subgenera proposed for mollusks. Perhaps the most recent is that of Burch (1956, p. 144). Earlier, Cotton and Godfrey (1938, in their authors' preface) made the following statement:

Here we may note that if all the so-called genera introduced and available for South Australian shells were used, there would be very few genera with more than one or two species. We have endeavoured to steer a middle course. For the purposes of this handbook, we have used the stronger forms of subgenera as full genera, and wholly discarded the weaker ones.

And still earlier, Grant and Gale (1931, p. 88) made the following assertions:

One extreme is the old Linnean policy of classing the whole of the mollusca under a score or two of genera; the other extreme is to have a genus for every species. There is something to be said for the former extreme, for a few names are easy to remember and to use and they divide the class into two [sic] groups each of which is easier to handle as a unit than the whole class. Nothing can be said in favor of the latter extreme, for it is the equivalent of discarding generic names altogether and making specific names twice as long

and more than twice as hard to handle. The Linnean system was meant to be binomial, and to be most useful the generic name was meant to be markedly different in breadth of application from the specific. Even a generic name for every well-marked species is almost obviously too close to the more unreasonable of the two extremes, for it makes the nomenclature too cumbersome, with too many names, all apt to be involved in nomenclatorial, time-wasting difficulties. Besides, the genera are needed for showing broader relationships, and the unit of the well-marked species and its close or doubtfully distinct relatives can be handled more satisfactorily in other ways.

Grant and Gale continued in this vein on p. 89.

It is a true, though very unfortunate, circumstance that arguments in justification of a multiplication of names are too often merely a form of ratiocination engendered, usually subconsciously, by a desire for the supposed glory of being author of the new names. During times when the multiplication of names is popular, many writers indulge in it as a sort of speculation not unlike speculative inflation of the stock market, and the process keeps on until the market is glutted with such securities and deflation and hard times ensue, it not a nomenclatorial panic, followed by a gradual return to a more reasonable intermediate position. Such fluctuations are costly in wasted energy, and it is better for science not to speculate too much in this way.

There have been a few additional doubters as to the good that continual splitting of genera will do for the classification of the Mollusca, but these few outcries of caution have done little or nothing to stem the flood of new generic and subgeneric names.

On the other hand, there are many taxonomists who give reasons for splitting genera and subgenera of mollusks. Only a few of them will be reviewed here.

One of the biologically least sound reasons for generic splitting was plainly stated by Crickmay (1932, p. 445) in his work on the Trigoniidae.

In the first place, the number of species is now so large, there being about 900 of them, that to retain *Trigonia* as a comprehensive genus defeats the prime object of classification, as it did with "*Ammonites*" and "*Belemnites*".

Simpson (1945, p. 16) rebuts Crickmay with the following statement:

The practical classifier grants to a genus a certain "size," by which is meant, as a rule, a certain morphological scope, with the implication that this scope tends to approximate a certain degree of phylogenetic differentiation, to include all animals related to each other within certain limits. This morphological scope may be almost entirely filled or exploited by known species if the genus has many (is polytypic), or only one or a few species may be known, leaving much of the assigned scope blank.

It seems clear that Crickmay did not have in mind the concept of size as expressed by Simpson when he suggested the splitting of *Trigonia*. Crickmay's idea of size is the one generally expressed by taxonomists of the Mollusca—mere number of species, regardless of morphologic scope.

Crickmay's other reasons for splitting the genus *Trigonia* are certainly more valid and are as follows:

In the second place, the genus *Trigonia*, as formerly conceived, is an incongruous one: certain of the groups which it comprises, for instance, Costatae and Clavellatae, are clearly distinct throughout their entire geologic history. Each one is very unlike the other, yet each bears resemblances to separate species among the ancestral genus *Myophoria* in the broad sense. In the third place, even the conservative characters of each of the many groups of species are so different as to merit nomenclatorial distinction. Lastly, a comparative view of taxonomic methods brings into evidence a great and undesirable discrepancy between the comprehensiveness of the genus *Trigonia* and the limitation of genera of other classes of animals.... Other families of pelecypods furnish excellent illustrations of the narrow limits assigned to genera by modern zoologists. For instance, some of the genera of the Veneridae differ only in the manner of shell ornament.

The last reason quoted above is not entirely supportable. The discrepancy between the comprehensiveness of some genera and the limitation of others, although regrettable, is not a sound basis for continuing an unwise practice. For example, it would be the height of taxonomic folly to split all families to the extent that the Inoceramidae have been split, merely to eliminate discrepancies in comprehensiveness.

Bartsch (1955, p. 5) in his paper on the Pliocene pyramidellids of Florida gives

the following reason for additional splitting:

Since it is my belief that it will be easier for students to become acquainted with the members of smaller genera, I shall herein elevate some of the subgenera used by Dall and Bartsch to generic rank.

If Bartsch deems it necessary to study small groups, why can he not study them as subgenera? In raising their rank he has in no way diminished their size and has eliminated a useful category. Furthermore, he has defeated his own stated purpose (viz., making things "easier") by necessitating the students' becoming acquainted with more numerous genera and genera which, being more finely delimited, are more difficult to distinguish from one another. Nevertheless, in this same paper Bartsch proceeds to erect two new genera, one new subgenus, and one new pseudogenus, whatever that is.

Marwick (1957, p. 144) in his discussion of the Turritellidae has stated:

The genus *Turritella*, as widely interpreted, comprises over 1,000 named species and subspecies, ranging in age from the Lower Cretaceous, perhaps Jurassic, to Recent, and distributed throughout the world. It is thus too comprehensive to be as useful in taxonomy, stratigraphy, or palaeogeography as it could be if more restricted.

I disagree with Marwick on the grounds that the splitting of genera solely for the sake of stratigraphy and paleogeography (paleobiogeography?) is not valid. Splitting should be based on the differentiation of distinct morphologic characters. Especially in the Paleozoic strata, a species, let us say, collected from Silurian strata is often allocated to one pelecypod genus, and a species very similar in all morphologic characteristics collected from undoubted Devonian strata is allocated to a different genus. To what genus does the stratigrapher allocate the species if he is not certain whether he is dealing with Silurian or Devonian strata? This whole idea strongly smacks of Werner's catastrophism.

Here again the application to stratigraphy comes to the fore. Among the most notorious "splitters" have been the paleontologists with basic interests in stratigraphy. According to their view, the more narrowly

defined a genus or a species is, the more useful it will be in narrowly delimiting stratigraphic units. They contend there should be a name for every variation, and true taxonomic relationship (i.e., the nomenclatorial expression of morphologic scope) is disregarded. This giving of scientific names for every minor or local variant by some stratigraphers may help to solve some local stratigraphic problems, but it defeats the larger purpose of world-wide correlation which is the major interest of other stratigraphers. See Newell, 1956, pp. 66, 73.

And finally, coming back to the relatively lengthy discussion by Grant and Gale on this subject, they state some reasons in opposition to the splitting of genera (p. 89).

A strange argument has recently been put forth to justify creating many new generic names and confining the older well-known names to small insignificant groups of species, namely that as the older names are usually of doubtful nomenclatorial status and their exact application is often subject to change, fewer species will be involved in the changes. In other words, it is suggested to make the unwelcome changes now to avoid the possibility of having to make them later. It might be noted here that if genera are used in a broad sense, such changes will usually mean merely a rearrangement of subgenera. Another argument to justify creating new generic names and limiting old ones is that the inclusion of various species in a genus should indicate that they are fairly closely related, whereas we often do not know whether they are or not, except that they appear to have a number of characters in common. If genera were smaller there would be less risk of including heterogeneous elements. However, if there were no genera, there would be still less risk, so the problem falls back again on the principle of the convenience of taking some risks in order to express relationships still imperfectly known, and the amount of risk that should be taken must be governed by the special circumstances of each case.

Undoubtedly the most unfavorable aspects of generic splitting have been the haphazard and irresponsible way in which it has been perpetrated in many cases. Some of the proposals of new genera and subgenera are found in faunal monographs. The faunal monographers too often do not know the range of variation of morphological characters within a family and, further-

more, do not know which characters are relatively stable and which are variable within a family. As an example, Iredale (1939, p. 302) erected *Tucetopsis* as a subgenus of *Tucetona* on such superficial and unstable characters as arrangement of the prionodont teeth on the hinge plate, the elevation of the adductor muscle scars, striations on the interior of the shell, and the shape of the crenulations on the interior ventral margin. *Tucetopsis* is just another meaningless name to be burdened with in the pelecypod family Glycymerididae. I can also see no reason for Finlay and Marwick's subgenus *Cucullona* (1937, p. 19) when *Latiarca* Conrad, 1862, is available; their attempt (p. 20) to distinguish between the two subgenera is certainly not convincing. Other examples could be brought forth, but these two should suffice. Such methods of erecting new genera and subgenera on shallow foundations, although some prove to be valid and useful, do more mischief than good.

Almost equally undesirable, however, would be the opposite extreme, an attempt to return to the methods of 150 years ago. The old Linnean and Lamarckian interpretations of generic names, although still used by many conservative workers, are so generalized—so lacking in preciseness of connotation—as to be uninformative. This deficiency can be illustrated by a comparison of the old, generalized (*sensu lato*), Lamarckian interpretation of *Arca* with the modern (*sensu stricto*) concept of *Arca*. The advantage of the latter is that it tells

us a great deal about a species without benefit of a detailed description or picture, or both. Another illustration is provided in the consideration of the old (broad) and modern (restricted) concepts of *Glycymeris*. (See below.)

In other words, a genus name should tell us in some detail the following facts about a species to which it is applied: its morphologic scope, its geographic distribution, its habitat, and something about its stratigraphic range if it has a geologic history. (I repeat, however, that a genus should not be split on the basis of the latter factors if a morphologic reason is lacking.)

Why, then, do some taxonomists still use only the Linnean and Lamarckian concepts of genera in their faunal studies? The answer is obvious: Many modern genera have been so finely delineated and are now so difficult (if not impossible) to distinguish from each other that the taxonomist seeking to allocate a species cannot find just one appropriate genus to the exclusion of all others. I.e., his species might fit the descriptions of several different genera. Even an examination of the type species of the various genera may provide no solution, for the species in question may have a few characters in common with each of several different type species but, in totality, be no more closely related to one than to another. The taxonomist solves or evades his problem in one of three ways:

1. He creates a new genus or subgenus for the species at hand, thus compounding the difficulties of future workers.

Arca, sensu lato

Quadrangle, subcircular, or rectangular in outline.
Longer than high or higher than long.
Attached by byssus or free living.
With or without byssus and byssal gape.
Living at shallow or moderate depths—0–2,500 ft.
Living in tropical, temperate, or boreal regions.
Water temperature 38° to 80°F.
Living on rocky, sandy, or occasionally even silty substrate.

Glycymeris, sensu lato

Outline of valves subcircular or subquadrangular.
Radial ribs present or absent, raised or flattened, with or without superimposed radial striae.
Geologic range Cretaceous to Recent.

Arca, sensu stricto

Rectangular in outline.
Longer than high.
Attached by byssus.
With byssus and byssal gape; byssal fibers enclosed in a sheath.
Living at shallow depths—0–350 ft.
Living in tropical or warm temperate regions.
Water temperature 55° to 80°F.
Living on rocky substrate.

Glycymeris, sensu stricto

Outline of valves subcircular.
Radial ribs flattened with superimposed radial striae.
Geologic range Oligocene to Recent.

2. He arbitrarily assigns the species to an existing modern genus on grounds other than morphology—perhaps geography or stratigraphy—thus confounding the true purpose of taxonomy.

3. He resorts to vagueness, allocating the species to a time-honored and unprecise genus as established by Linné or Lamarck.

TAXONOMY AND THE PATTERN OF EVOLUTION

A knowledge of the progress of evolution in any group of organisms, even if the process is not wholly understood, is so intimately linked to classification that to ignore it courts taxonomic chaos. The next



FIG. 1.—Two examples of the hollow curve of distribution; number of genera plotted against number of species in each genus of pelecypods. Vertical scale is approximately five times that of the horizontal scale. Dashed line—data taken from Deshayes (1835-1836); number of genera 97, of which 11 are monotypic, 15 have 2 species, largest genus has 135 species. Solid line—data taken from H. and A. Adams (1858); number of genera 327, of which 42 are monotypic, 31 have 2 species, 31 have 3 species, 27 have 4 species, 23 have 5 species, largest genus has 126 species. The Adamses' classification is a much more modern treatment.

several paragraphs of this paper will be an attempt to show the broad pattern of evolution, in a very general and abbreviated way, and to show its essential relationship to taxonomy.

Any taxonomist who has an interest in a group of animals, whether it be a phylum, class, order, or family, soon realizes from the standpoint of synthesis (the practice of putting things together by showing relationships or similarities; see Simpson, p. 22, 1945) that relatively few groups have numerous species; many more groups have few species. One has only to look at the relative size of the animal phyla to see this truism. On the basis of described living species, no animal phylum is more than one-tenth the size of the Arthropoda. There are some modest-sized phyla headed by the Mollusca, Protozoa, and Chordata. There are many more that are quite small; for example, the Entoprocta, Echiuroida, Ctenophora, and Chaetognatha all have less than a thousand described species each. Some groups of animals seem to have remained small in numbers of species throughout their geologic history as, for example, the scaphopods among the Mollusca. Of course, others are small today because they are apparently nearing extinction. The fact remains, however, that certain animal phyla have been much more "successful" than others, having a very large number of species, having many modifications of the basic body-plan, and having through adaptive radiation invaded a wide variety of habitats.

Much of this success has been attributed to the ability of the group to adapt itself to the environment. But when one examines families or genera one is likely to grasp the idea that the basic reason is most often genetic. J. C. Willis (1949, pp. 355-369) has noted that in groups of plants certain morphologic characters and certain combinations of morphologic characters are common within a particular family, while other possible combinations are rare or absent. Restrictions of morphologic scope are, of course, the basis for defining the family; hence, among the pelecypods, a specimen exhibiting only the characters of an arcid cannot be classified as a cardiid. But even

within the individual family there is a reasonably great range of possibility in the combinations of morphologic characters, and the important fact is that some combinations are far more "successful" (i.e., common) than others. For a hypothetical example, let us take the following possibilities of characters—*ABCD* and *abcd*—within a family having 200 described species.

<i>A B C D</i> combination occurs in	100 species.
<i>A B C d</i> combination occurs in	60 species.
<i>A B c d</i> combination occurs in	20 species.
<i>A b c d</i> combination occurs in	10 species.
<i>a b c d</i> combination occurs in	3 species.
<i>a B C D</i> combination occurs in	2 species.
<i>a b C D</i> combination occurs in	2 species.
<i>a b c D</i> combination occurs in	1 species.
<i>a B C d</i> combination occurs in	1 species.
<i>a B c d</i> combination occurs in	1 species.

The other possible combinations of characters either await discovery or have never existed.

A more concrete example of this is the type of ribbing found in the pelecypod family Glycymerididae. There are six possible combinations of radial ribs, or lack of them, within the family.

1. Flattened main radial ribs with superimposed radial striae. This type of rib pattern occurs in more than half of the 700 described species of glycymeridids and is exemplified by the genus *Glycymeris*.

2. Raised radial ribs with no superimposed radial striae. This type of radial rib, with some modifications, occurs in more than 100 species of glycymeridids and is typified in the genera *Tucetona* and *Grandaxinaea*.

3. Flattened radial ribs with no radial striae superimposed. This type of ribbing occurs in less than 50 species of glycymeridids and is typified by the genus *Pseudaxinea*.

4. Raised radial ribs with superimposed radial striae. This type of ribbing is very rare but is most often seen in some of the most primitive glycymeridids.

5. Radial ribs absent. Less than 10 described species of glycymeridids have this lack of ribbing, typified by most species of *Postligata*.

6. Primary ribs absent but secondary radial striae present. This is seen in a few species, probably less than 10, of *Glycymeris*.

For some unexplainable reason, concentric ribs are not present among the glycymeridids or, at least, species having them are as yet undiscovered.

The foregoing is admittedly a slight oversimplification of the rib patterns in the

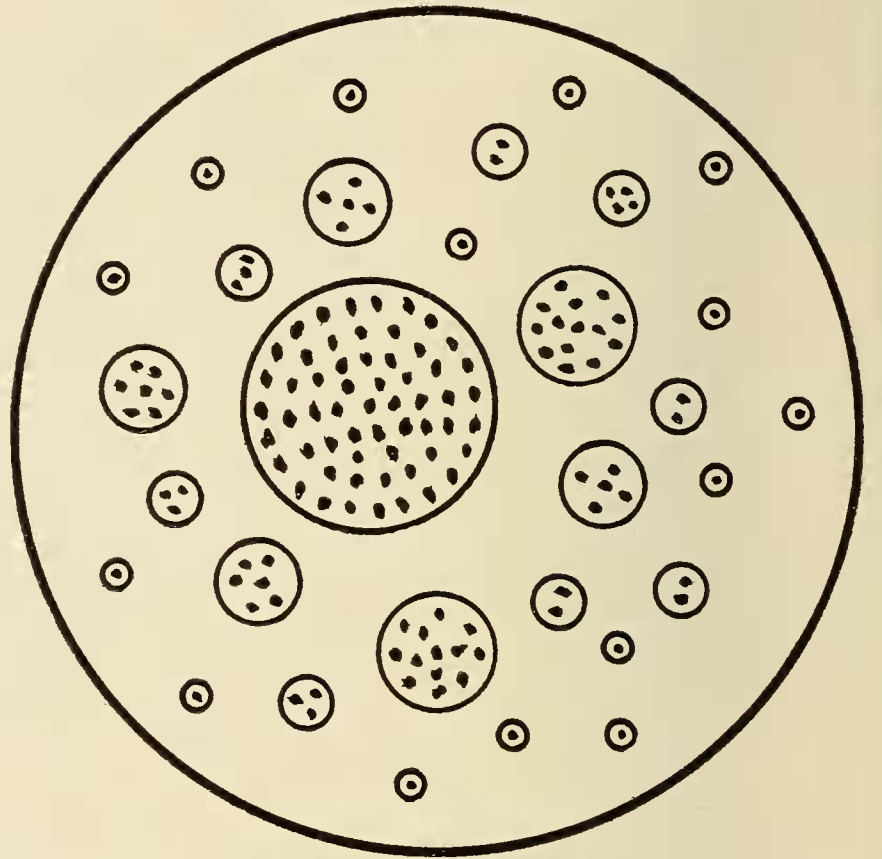


FIG. 2.—Typical distribution pattern of species within a family or subfamily. Outer circle represents family or subfamily; smaller circles represent genera and subgenera; dots represent species.

glycymeridids. The fact remains that the character of the radial ribs is one of the best criteria for dividing the family into genera and subgenera.

Another interesting morphological phenomenon in the Glycymerididae is that probably more than 99 percent of the species have crenulations on the interior ventral border. These crenulations may have an adaptive significance in that they may act as a supplementary locking device for the valves when closed. However, if the crenulations truly are an adaptive, rather than genetic, character, is it not strange that they rarely occur in the Limopsidae, a family having similarly shaped shells and the same type of hinge teeth? Additional genetic inferences may be drawn from the fact that although few glycymeridids lack radial ribs and even fewer lack crenulations, these two negative characters generally occur together in the same species, possibly indicating that they are genetically linked.

The phenomenon of genetic linkage is an indisputable basis for the commonness of certain combinations of morphologic characters and the scarcity of other combinations. If linkage is combined with one or more inversions, crossing over will be inhibited, and there is then little likelihood

that new combinations of morphologic characters will appear. Undoubtedly there are other genetic reasons, but the fact that there are more genes than chromosomes is certainly significant in the commonness of some combinations of morphologic characters and the scarcity or absence of others.

J. C. Willis in his book *Age and area* (1922) has been credited with the idea that the size of genera and higher categories is exemplified statistically by "the hollow curve of distribution." (Lotka, 1956, p. 313, calls the hollow curve a "hyperbola of the generalized type.") Briefly the idea of the hollow curve is this: If, for example, a family of 1,000 described species having 50 genera is examined, it is generally noted that there will be one, occasionally two, large genera containing perhaps half the species; the next genus, although fairly large, may contain only 250 species; the next will have about 150; then there will be many genera with a few species; and finally the pleurality of genera will be monotypic. When the number of genera is plotted against the number of species in each genus, a hollow curve is derived. Two hollow curves are shown in figure 1. Another hollow curve could be made by plotting the number of orders against the number of families in each order of mammals on the data given by Simpson (1945, p. 35). For other hollow curves see Ferris (1928, p. 115) and Willis (1949, pp. 260-261). For a good review of the hollow curve distribution see Chamberlin (1924, pp. 350-374).

Another way in which the distribution of a species can be depicted (figure 2) is by drawing a circle to represent a family. Within the large circle are smaller circles representing genera. Within each of the smaller circles are one or more dots representing species. It will be seen that most of the dots (species) occur in one or two large circles (genera), while most of the circles contain very few dots. This portrays the morphologic affinities of species within a family.

The significance of this short review of the hollow curve of distribution and related ideas is to show that in nature, from the standpoint of numbers of species, there are

a few large genera, families, and groups of higher rank. At each level there is a much larger number of modest-sized groups and a still larger number of small groups. Most zoologists strive for what they term a natural classification, by which is meant the grouping together of animals on the basis of phyletic relationship, when known, and morphologic affinity—e.g., all gastropods in one large group, all pelecypods in one medium-sized group, and all scaphopods in one small group. It cannot be overemphasized that large, medium-sized, and small groups all are natural; and, returning to the subject of the Pelecypoda, any attempt to "equalize" the groups by splitting the vastly polytypic genera or lumping together the monotypic genera will ultimately discredit the science of taxonomy.

CONCLUSIONS

There must be a distinct morphological gap between a genus and its nearest relatives. To put it more pragmatically, if a species is morphologically assignable to more than one genus, the genera have been split too finely. The generic category is basically nothing more than a key for the morphologic grouping of species, just as the familial category is a key for the grouping of genera. In other words, if a key cannot be made to distinguish the genera from each other on morphologic grounds, then generic splitting has either gone too far or been poorly done, or both.

The matter of size has nothing to do with the case, except as Simpson uses the word—to connote morphologic scope; one genus may properly have as many as 1,500 species and another in the same family may have but one species. If the genus is an artificial category, as so many of the modern taxonomists insist, at least it should be a pragmatic category; otherwise it is useless and meaningless. Such statements as "for practical reasons the genus, to be a convenient category in taxonomy, must in general be neither too large nor too small" (Thorpe, 1940, p. 357) have little taxonomic merit, despite the fact that this statement has been quoted and, by implication, endorsed by Mayr (1942, p. 283) and Marwick (1957a, p. 12). I see no convenience

in arbitrarily assigning a quota of species to each genus. On the contrary, considerable inconvenience arises when, as often happens, the genera are delimited so finely and on such tenuous grounds that a single species is allocable to more than one genus. Also, from the standpoint of a phylogenetic classification, this artificial uniformity of size does not make any sense. The genus should stand for a concept of morphologic characters just as much as the species. The word "convenience" has been used with great regularity when discussing sizes of genera and higher categories in papers on taxonomy written in the past 15 years. I must ask: What is "convenient" about having genera all the same size? For whom is this "convenient?"

On the same page Thorpe decries "that *reductio ad absurdum* the monotypic genus." It would be interesting to see what he would do with the monotypic genus *Euloxa*, which various paleontologists have placed in at least three different pelecypod families. If *Euloxa* is so distinctive that even its family is doubtful, how could it be incorporated into another genus?

The problem, then, is to find a reasonable mean between the extremes of splitting and combining. When should a new genus be proposed? As a good "rule of thumb," if a taxonomist believes he has discovered an undescribed genus, having canvassed the literature in the field and found nothing like it previously described, the more difficulty he has in placing it in a family, the more likely it is that he has actually discovered an undescribed genus. This thought is certainly not an original one; most taxonomists use it either consciously or subconsciously.

Recent workers in the field of taxonomy would do well to read the chapter on Classification (pp. 108-127) in the late G. F. Ferris' excellent work, *The Principles of Systematic Entomology*, which was published in 1928. Ferris (p. 111) makes one point which every taxonomist should remember:

To divide a genus artificially merely for the sake of "convenience" is the negation of scientific method. If there are actually five hundred species

in any group so closely related that their relationships can best be expressed by keeping them in a single genus it were inexcusable from any scientific point of view to break up the genus merely to get smaller groups.

On page 123 Ferris makes another good point.

It has already been indicated—but it may here be repeated with greater emphasis—that the *essence of classification is grouping*. The genus is essentially a *group* of closely related species. It is clear then that the tendency should be rather to hold species together—to conserve groups—than to separate them, unless that separation be the separation of *groups*. In other words, the monotypic genus, *in general*, is undesirable. This is not to say that monotypic genera should never be named, for there unquestionably are numerous forms so isolated from their nearest *known* relatives that to insist on keeping them attached to another group merely to avoid naming a monotypic genus would merely obscure the fact of their divergence.

There is no field of biology where good judgment and the application of common sense are more needed than in taxonomy.

ACKNOWLEDGMENT

The writer is particularly indebted to Dr. Edna Dudgeon of the Department of Zoology at Southern Illinois University for some ideas in genetics.

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ARAUCANIAN WITCHCRAFT

Witches, male and female, are potent, malevolent figures among the Araucanian Indians of southern Chile and Argentina. Each witch, or *kalku*, had his personal supernatural formula for doing evil, but occasional meetings are held in the forest for exchange of professional experiences. They may even trade secrets, which apparently are only variations of generally known formulae. The calling, however, is a perilous one for the practitioner.

The prevailing witchcraft customs are described by Sister M. Inez Hilger, Benedictine nun of St. Joseph, Minn, in a report recently issued by the Smithsonian. She carried out her studies while on a research expedition among the Araucanians.

A favorite point of attack, either for a fee or from pure malevolence, is a wheatfield. "The medium used," says the report, "is the mean of any 4-footed animal and/or eggs, which are bewitched and buried in the field." If a crop shows signs of failure there is little question on the part of the owner as to the cause of what must be done about it. An informant told the investigator: "They will then search in the field for meat—it is usually wrapped in a rag and can be found. . . . If they [the owners] find the meat, they hang it over the edge of the fire in the *ruka* so that it will dry up. This will cause the one who buried it to dry up, also. Others stick it full of needles and lay it in the sun. The one who did the damage then feels the pain of the needles. . . . Soon after that a terrible sickness will come over him. . . . His entire body

will tremble. If the sun shines, he will go out and stay in the hot sunshine [something not done by sane persons]."

According to another informant, "the *kalku* can use eggs in place of meat, if he wishes to. . . . After the bewitched meat or eggs are in the field for several days, the wheat in that field either turns yellow or shrivels up. If they find the buried meat, they will hang it over a fire and cause the person who did the damage to shrivel up just like the wheat. . . . But if the one whose field was injured does not wish to take revenge, . . . he will throw the meat into the river." The suspected *kalku* may be a close relative or even a personal friend.

Once the meat is found the unfortunate *kalku* can be kept on tenterhooks, however, for as long as the intended victim wishes. As related by an Araucanian school teacher, an old woman was caught burying eggs and meat in the field of her brother-in-law. He immediately dug up the meat and hung it over a fire. The woman took sick with asthma and began to lose weight. She was sick for two years. By that time the man took pity on his brother, the woman's husband, and threw the meat into the creek. As it took shape slowly by absorbing the water the woman gradually got better and finally got well.

In another area a common form of revenge against the witch is to poke two sticks at right angles through one of the eggs found in a field and then hang the egg over a fire. The one who did the damage will become blind or have an arm paralyzed.